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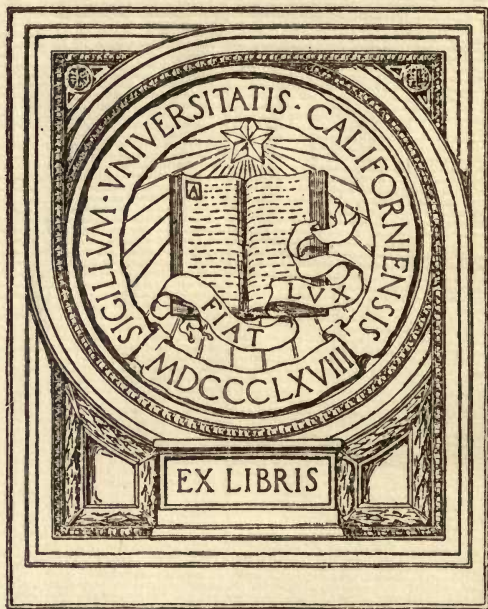
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EXCHANGE



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No. 6.—ON THE STRESSES DEVELOPED IN BEAMS LOADED
TRANSVERSELY.

BY

HENRY T. BOVEY, LL.D.

[Reprinted from the Trans. of the Royal Society of Canada, Section iii,
pp. 3-28, May 27, 1902.]

MONTREAL, 1902.

UNIV. OF
CALIFORNIA

ROYAL SOCIETY OF CANADA

TRANSACTIONS

SECTION III.

MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

PAPERS FOR 1902

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EXCHANGE

—On the Stresses Developed in Beams Loaded Transversely.

By HENRY T. BOVEY, F. R. S.

(Read May 27, 1902.)

The present paper contains further results obtained with the new extensometer described in Section III., Vol. VII., of the "Transactions" of the Royal Society of Canada, in the year 1901-02:

The loading was of the same description and of two kinds, namely, (1) loads of increasing magnitude were placed at the centre; and (2) equal loads of increasing magnitude were concentrated at two points equidistant from the centre, the maximum B. M. in each case being the same as for the corresponding centrally placed load.

In all measurements, the beams were placed on supports 60 ins. apart and the distance between the extensometer points was 8 ins.

In each set of observations, the horizontal row at the top of the columns gives the loads successively placed on the beam, and the columns under the several loads give the corresponding changes of length between the extensometer points in millions of an inch, each change of length being the average obtained from five to ten observations.

The decrements and increments of length are indicated by negative and positive signs respectively.

A.—EXPERIMENTS WITH AN 8 IN. STEEL ROLLED JOIST WEIGHING
49½ LBS. PER LINEAL YARD.

An extensometer was placed horizontally at the centre of gravity of the section and extensometers were also placed on parallel lines at distances of 1.27 ins., 2.54 ins. and 3.81 ins., above and below the centre of gravity, the extensometers in the last case being on the flanges.

LOADS CONCENTRATED AT 30-IN. CENTRES.

3,000 lbs.	6,000 lbs.	9,000 lbs.	12,000 lbs.	15,000 lbs.
— 935	— 1701	— 2415	— 3126	— 3824
— 641	— 1228	— 1778	— 2325	— 2840
— 323	— 617	— 903	— 1101	— 1460
— 6	+ 2	+ 13	+ 22	+ 25
+ 311	+ 627	+ 937	+ 1239	+ 1536
+ 631	+ 1256	+ 1863	+ 2446	+ 3008
+ 891	+ 1682	+ 2478	+ 3252	+ 4038

By plotting the above results, diagram I. is obtained.

DIAGRAMS FOR 8 IN. ROLLED JOIST

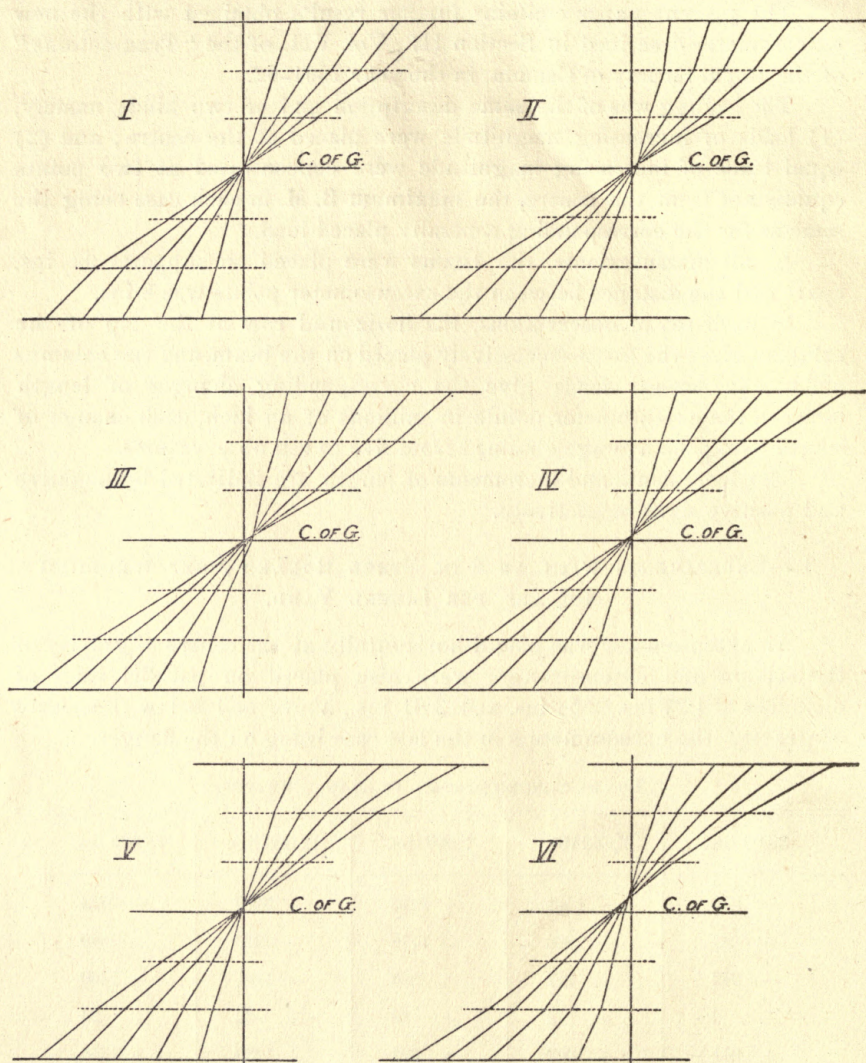


TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
3000	45000	·011
6000	90000	·024
9000	135000	·038
12000	180000	·051
15000	225000	·063

LOADS CONCENTRATED AT 20-IN. CENTRES.

2,250 lbs.	4,500 lbs.	6,750 lbs.	9,000 lbs.	11,250 lbs.
— 778	— 1532	— 2334	— 3208	— 4075
— 645	— 1265	— 1860	— 2452	— 3027
— 337	— 679	— 1014	— 1350	— 1671
— 10	— 38	— 69	— 100	— 133
+ 306	+ 597	+ 887	+ 1172	+ 1452
+ 637	+ 1257	+ 1870	+ 2475	+ 3068
+ 942	+ 1840	+ 2664	+ 3404	+ 4268

By plotting the above results, diagram II. is obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
2250	45000	·013
4500	90000	·015
6750	135000	·017
9000	180000	·019
11250	225000	·021

LOADS CONCENTRATED AT 15-IN. CENTRES.

2,000 lbs.	4,000 lbs.	6,000 lbs.	8,000 lbs.	10,000 lbs.
— 879	— 1711	— 2482	— 3323	— 4153
— 656	— 1267	— 1865	— 2446	— 3029
— 352	— 694	— 1051	— 1419	— 1728
— 22	— 47	— 86	— 123	— 156
+ 295	+ 591	+ 872	+ 1156	+ 1435
+ 629	+ 1243	+ 1838	+ 2429	+ 3003
+ 933	+ 1859	+ 2685	+ 3502	+ 4290

By plotting the above results, diagram III. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
2000	45000	·012
4000	90000	·023
6000	135000	·034
8000	180000	·047
10000	225000	·059

LOADS CONCENTRATED AT 8-IN. CENTRES.

1,730 lbs.	3,460 lbs.	5,190 lbs.	6,920 lbs.	8,650 lbs.
— 913	— 1778	— 2632	— 3473	— 4318
— 599	— 1164	— 1707	— 2239	— 2751
— 290	— 559	— 811	— 1066	— 1310
+ 15	+ 40	+ 75	+ 109	+ 145
+ 327	+ 659	+ 995	+ 1318	+ 1645
+ 636	+ 1264	+ 1836	+ 2495	+ 3066
+ 1068	+ 2014	+ 2862	+ 3683	+ 4486

By plotting the above results, diagram IV. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1730	44980	·011
3460	88960	·021
5190	134940	·032
6920	179920	·043
8650	224900	·054

LOADS CONCENTRATED AT 6 IN. CENTRES.

1,665 lbs.	3,330 lbs.	4,995 lbs.	6,660 lbs.	8,325 lbs.
— 1050	— 1924	— 2775	— 3587	— 4385
— 594	— 1147	— 1653	— 2149	— 2637
— 290	— 548	— 795	— 1038	— 1271
+ 11	+ 45	+ 80	+ 119	+ 165
+ 317	+ 641	+ 964	+ 1289	+ 1605
+ 627	+ 1235	+ 1846	+ 2423	+ 2965
+ 922	+ 1777	+ 2612	+ 3413	+ 4177

By plotting the above results, diagram V. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1665	44955	·011
3330	89910	·021
4995	134865	·031
6660	179820	·042
8325	224775	·053

LOAD CONCENTRATED AT CENTRE.

3,000 lbs.	6,000 lbs.	9,000 lbs.	12,000 lbs.	15,000 lbs.
— 847	— 1660	— 2488	— 3270	— 4077
— 471	— 927	— 1409	— 1873	— 2311
— 142	— 298	— 486	— 712	— 837
+ 120	+ 220	+ 285	+ 311	+ 378
+ 387	+ 742	+ 1063	+ 1376	+ 1687
+ 635	+ 1233	+ 1796	+ 2384	+ 2907
+ 1099	+ 2049	+ 2866	+ 3707	+ 4504

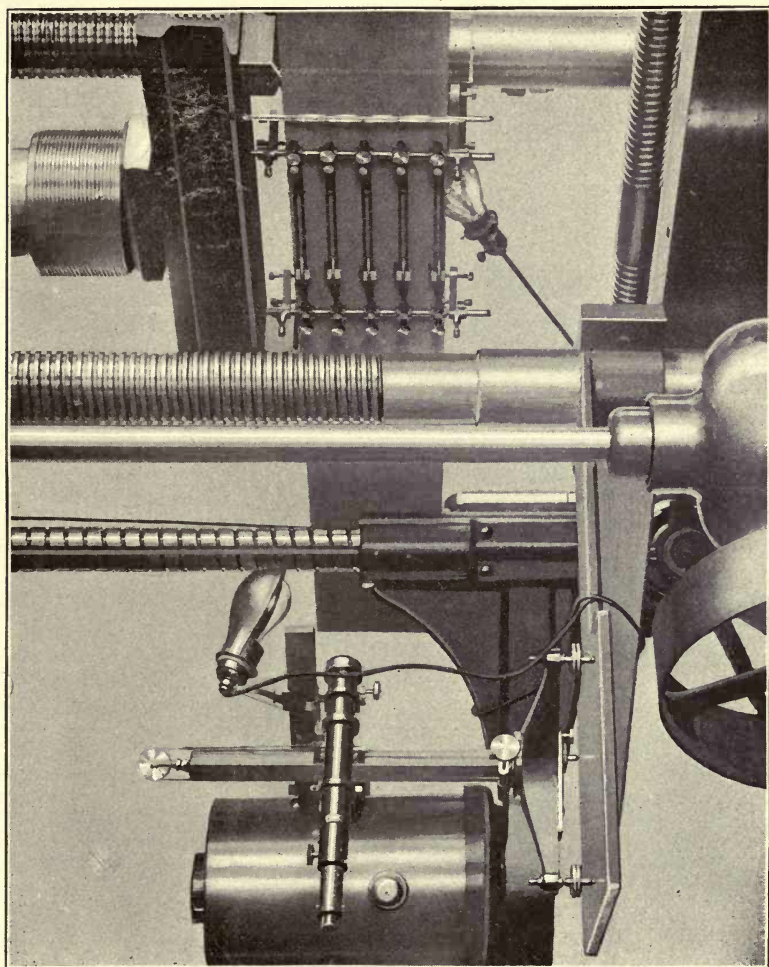
By plotting the above results, diagram VI. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
3000	45000	·01
6000	90000	·02
9000	135000	·03
12000	180000	·04
15000	225000	·05

In diagram IV., in which the loads are concentrated at 8-in. centres, the stress in the material is almost directly proportional to the distance from the neutral axis which seems to be slightly above the centre of gravity.

The diagrams for the 30-in., 20-in. and 15-in. concentrations indicate that the stress in the material increases more rapidly than the distance from the neutral axis, while the increase is not so rapid for the 6-in. concentration and for the beam loaded at the centre. In the last case, the neutral axis has moved very appreciably above the centre of gravity.

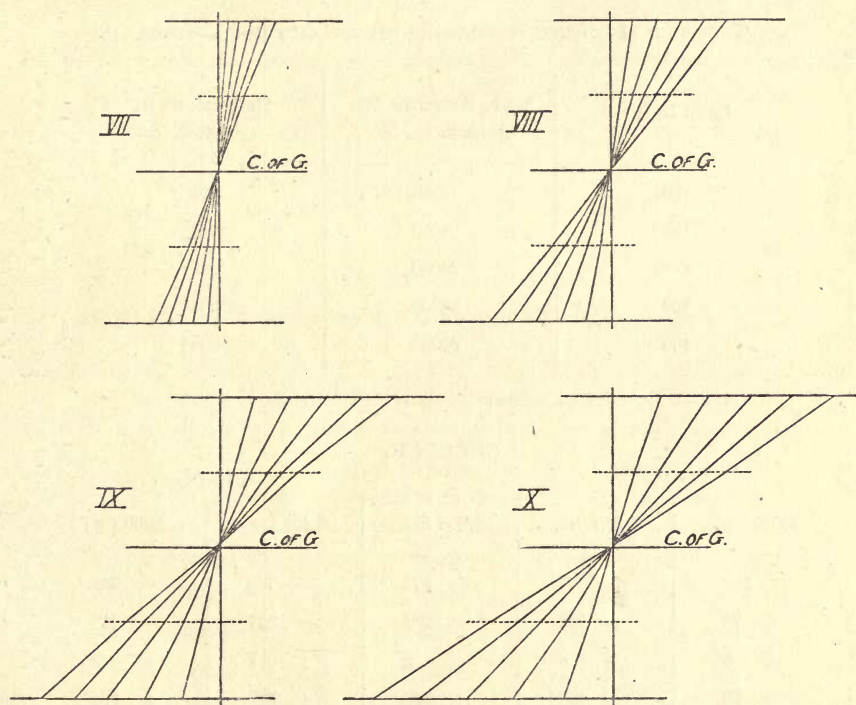


PHOTOGRAPH SHOWING EXTENSOMETERS IN PLACE ON SIDE OF CAST STEEL BEAM.

B.—EXPERIMENTS WITH A 7·85-IN. $\times$ 3·425-IN. CAST STEEL
BEAM WEIGHING 496 $\frac{1}{4}$ LBS. PER CUBIC FOOT.

Five extensometers were used with this beam, one being placed horizontally at the centre of gravity and the remainder on parallel lines at distances of 1·8125 ins. and 3·625 ins. above and below the centre of gravity.

DIAGRAMS FOR CAST-STEEL BEAM WITH LOADS
CONCENTRATED AT 30 IN. CENTRES



SERIES I.

LOADS CONCENTRATED AT 30-IN. CENTRES.

800 lbs.	1,600 lbs.	2,400 lbs.	3,200 lbs.	4,000 lbs.
— 87	— 174	— 269	— 361	— 457
— 38	— 81	— 122	— 170	— 211
+ 0	+ 1	+ 4	+ 6	+ 8
+ 34	+ 97	+ 142	+ 197	+ 240
+ 92	+ 205	+ 310	+ 412	+ 515

By plotting the above results, diagram VII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in. lbs.	Deflections in inches.
800	12000	·001
1600	24000	·0015
2400	36000	·003
3200	48000	·0045
4000	60000	·0055

SERIES II.

1,600 lbs.	3,200 lbs.	4,800 lbs.	6,400 lbs.	8,000 lbs.
— 183	— 377	— 575	— 760	— 935
— 78	— 166	— 263	— 357	— 447
+ 6	+ 8	+ 8	+ 7	+ 7
+ 92	+ 188	+ 280	+ 375	+ 473
+ 202	+ 405	+ 601	+ 789	+ 975

By plotting the above results, diagram VIII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in. lbs.	Deflections in inches.
1600	24000	·002
3200	48000	·004
4800	72000	·007
6400	96000	·0085
8000	120000	·011

SERIES III.

2,400 lbs.	4,800 lbs.	7,200 lbs.	8,60 lbs.	12,000 lbs.
— 272	— 559	— 840	— 1120	— 1383
— 119	— 242	— 368	— 493	— 616
+ 8	+ 17	+ 26	+ 37	+ 49
+ 145	+ 297	+ 447	+ 602	+ 757
+ 304	+ 605	+ 901	+ 1176	+ 1440

By plotting the above results, diagram IX. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
2400	36000	·003
4800	22000	·006
7200	108000	·010
9600	144000	·014
120000	180000	·017

SERIES IV.

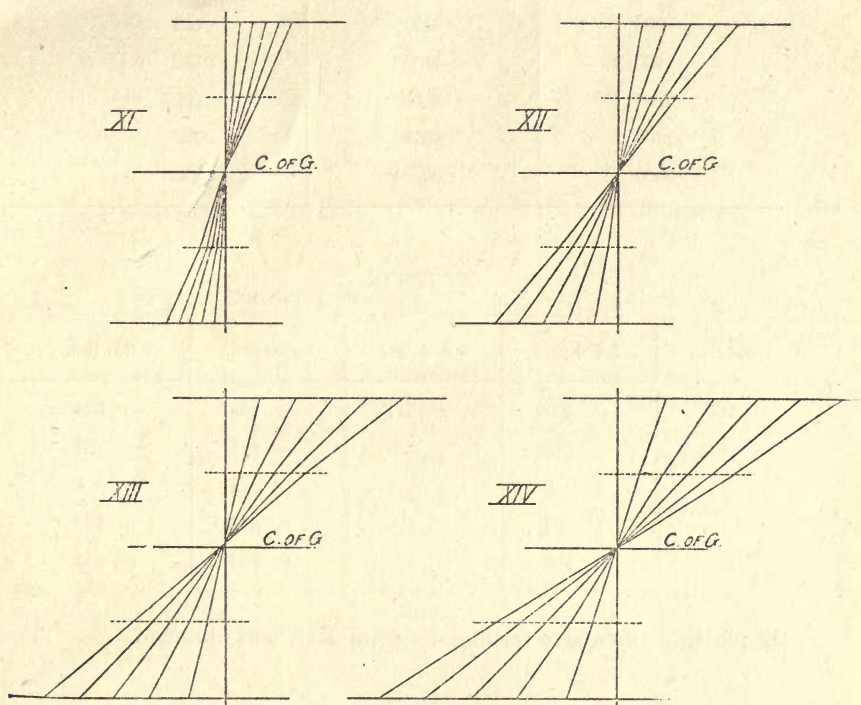
3,200 lbs.	6,400 lbs.	9,600 lbs.	12,800 lbs.	16,000 lbs.
— 387	— 763	— 1116	— 1438	— 1767
— 172	— 360	— 545	— 724	— 900
+ 8	+ 2	+ 13	+ 15	+ 35
+ 184	+ 370	+ 578	+ 780	+ 990
+ 398	+ 795	+ 1177	+ 1551	+ 1913

By plotting the above results, diagram X. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
3200	48000	·004
6400	96000	·009
9600	144000	·013
12800	192000	·018
16000	240000	·028

DIAGRAMS FOR CAST-STEEL BEAM WITH LOADS
CONCENTRATED AT 20 IN. CENTRES



SERIES I.

LOADS CONCENTRATED AT 20 IN. CENTRES.

600 lbs.	1 200 lbs.	1,800 lbs.	2,400 lbs.	3,000 lbs.
- 104	- 212	- 318	- 421	- 521
- 58	- 112	- 168	- 218	- 272
- 2	- 3	- 6	- 12	- 15
+ 35	+ 70	+ 119	+ 155	+ 202
+ 86	+ 185	+ 286	+ 379	+ 475

By plotting the above results, diagram XI. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in. lbs.	Deflections in inches.
600	12000	·001
1200	24000	·002
1800	36000	·0035
2400	48000	·005
3000	60000	·0055

SERIES II.

1,200 lbs.	2,400 lbs.	3,600 lbs.	4,800 lbs.	6,000 lbs.
— 188	— 378	— 577	— 765	— 942
— 81	— 168	— 265	— 361	— 451
+ 7	+ 3	+ 4	+ 2	+ 4
+ 89	+ 187	+ 276	+ 368	+ 467
+ 195	+ 403	+ 599	+ 799	+ 980

By plotting the above results, diagram XII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in. lbs.	Deflections in inches.
1200	24000	·001
2400	48000	·003
3600	72000	·0055
4800	96000	·0075
6000	120000	·0094

SERIES III.

1,800 lbs.	3,600 lbs.	5,400 bs.	7,200 lbs.	9,000 lbs.
— 279	— 566	— 851	— 1132	— 1406
— 126	— 254	— 383	— 512	— 638
+ 2	+ 10	+ 16	+ 24	+ 32
+ 143	+ 296	+ 445	+ 596	+ 747
+ 299	+ 603	+ 889	+ 1175	+ 1453

By plotting the above results, diagram XIII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1800	36000	·003
3600	72000	·006
5400	108000	·009
7200	144000	·012
9000	180000	·015

SERIES IV.

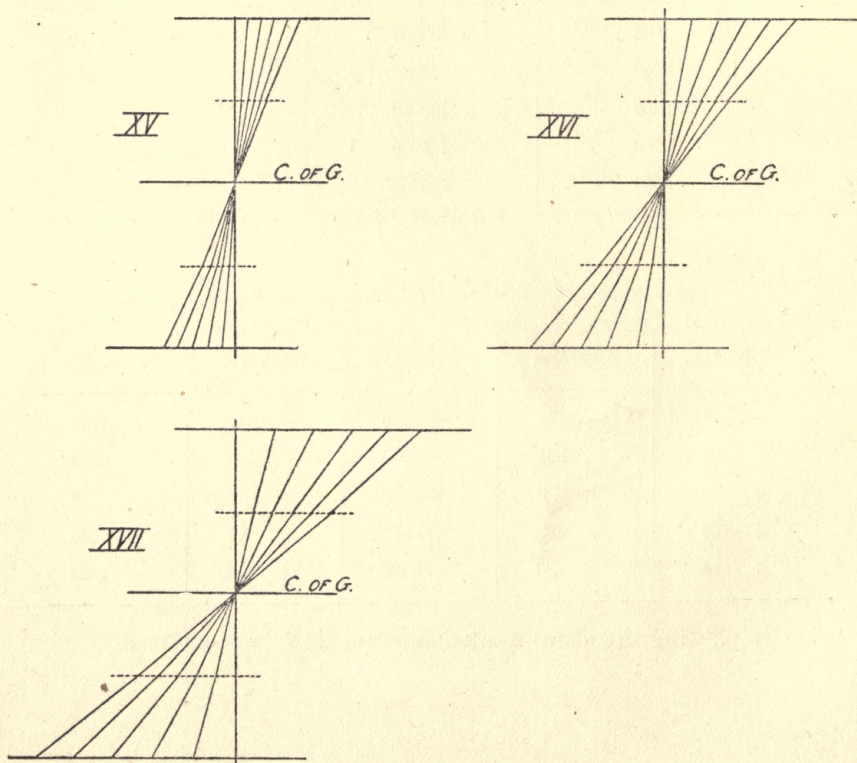
2,400 lbs.	4,800 lbs.	7,200 lbs.	9,600 lbs.	12,000 lbs.
— 381	— 761	— 1116	— 1447	— 1781
— 168	— 361	— 549	— 742	— 919
+ 9	+ 3	+ 8	+ 6	+ 10
+ 190	+ 369	+ 572	+ 77	+ 969
+ 406	+ 80	+ 1178	+ 154	+ 1906

By plotting the above results, diagram XIV. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
2400	48000	·004
4800	96000	·009
7200	144000	·013
9600	192000	·017
12000	240000	·021

DIAGRAMS FOR CAST-STEEL BEAM WITH LOADS
CONCENTRATED AT 15 IN. CENTRES



SERIES I.

LOADS CONCENTRATED AT 15-IN CENTRES.

535 lbs.	1,070 lbs.	1,605 lbs.	2,140 lbs.	2,675 lbs.
— 92	— 191	— 281	— 380	— 475
— 47	— 095	— 138	— 189	— 236
+ 1	+ 1	+ 1	+ 1	+ 1
+ 39	+ 84	+ 135	+ 178	+ 229
+ 94	+ 196	+ 307	+ 407	+ 506

By plotting the above results, diagram XV. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
535	13138	·001
1070	26276	·002
1605	39414	·003
2140	52552	·004
2675	65690	·005

SERIES II.

1,070 lbs.	2,140 lbs.	3,210 lbs.	4,280 lbs.	5,350 lbs.
— 190	— 387	— 581	— 771	— 946
— 84	— 172	— 272	— 369	— 460
+ 6	+ 2	+ 1	+ 1	+ 0
+ 86	+ 183	+ 275	+ 365	+ 464
+ 196	+ 406	+ 602	+ 797	+ 982

By plotting the above results, diagram XVI. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1070	26276	·001
2140	52552	·003
3210	78828	·0055
4280	105104	·0075
5350	131380	·010

SERIES III.

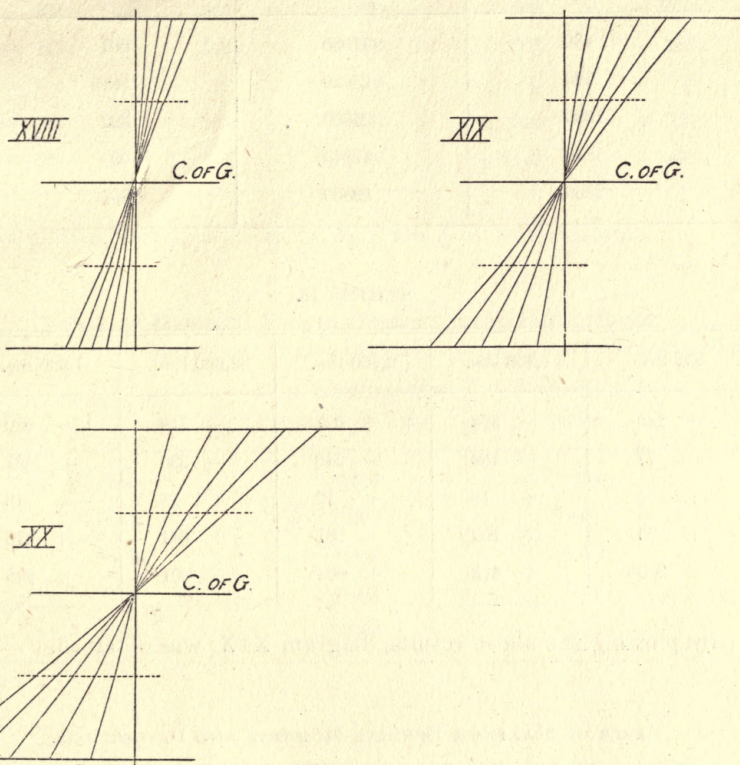
1,605 lbs.	3,210 lbs.	4,815 lbs.	6,420 lbs.	8,025 lbs.
— 284	— 572	— 850	— 1110	— 1359
— 129	— 167	— 416	— 555	— 692
+ 3	+ 6	+ 5	+ 4	+ 10
+ 144	+ 285	+ 425	+ 577	+ 726
+ 312	+ 614	+ 912	+ 1189	+ 1470

By plotting the above results, diagram XVII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1605	39414	·003
3210	78828	·006
4815	118242	·009
6420	157656	·013
8025	197070	·016

DIAGRAMS FOR CAST-STEEL BEAM WITH LOADS
CONCENTRATED AT 8 IN. CENTRES



SERIES I.

LOADS CONCENTRATED AT 8-IN. CENTRES.

460 lbs.	920 lbs.	1,380 lbs.	1,840 lbs.	2,300 lbs.
- 86	- 181	- 268	- 365	- 456
- 41	- 86	- 123	- 171	- 213
+ 3	+ 4	+ 6	+ 7	+ 8
+ 40	+ 89	+ 138	+ 194	+ 238
+ 101	+ 206	+ 316	+ 413	+ 515

By plotting the above results, diagram XVIII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
460	11960	·001
920	23920	·0015
1380	35880	·002
1840	47840	·003
2300	59800	·004

SERIES II.

925 lbs.	1,840 lbs.	2,760 lbs.	3,680 lbs.	4,600 lbs.
— 185	— 364	— 557	— 746	— 920
— 77	— 156	— 248	— 336	— 434
+ 4	+ 15	+ 12	+ 18	+ 13
+ 90	+ 199	+ 287	+ 381	+ 476
+ 200	+ 413	+ 608	+ 801	+ 990

By plotting the above results, diagram XIX. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
920	23920	·002
1840	47840	·0045
2760	71760	·0065
3680	95680	·0085
4600	119600	·010

SERIES III.

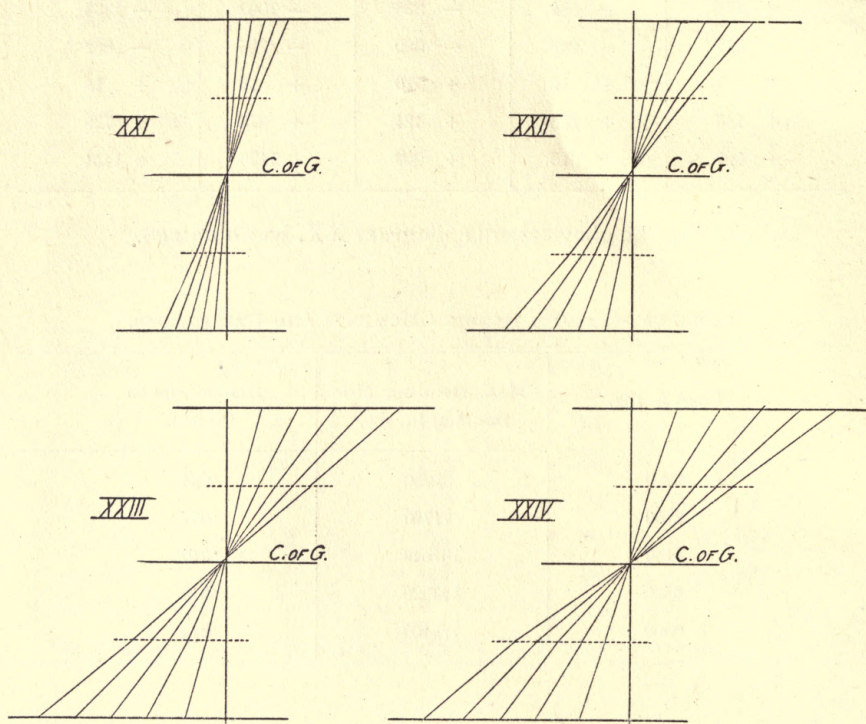
2,380 lbs.	2,760 lbs.	4,140 lbs.	5,520 lbs.	6,900 lbs.
— 274	— 559	— 836	— 1090	— 1333
— 117	— 248	— 389	— 525	— 662
+ 7	+ 12	+ 10	+ 16	+ 15
+ 145	+ 289	+ 424	+ 575	+ 720
+ 307	+ 610	+ 903	+ 1176	+ 1451

By plotting the above results, diagram XX. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in. lbs.	Deflections in inches.
2380	35880	·004
2760	71760	·007
4140	107640	·010
5520	143520	·012
6900	179400	·014

*DIAGRAMS FOR CAST-STEEL BEAM WITH LOADS
CONCENTRATED AT 6 IN. CENTRES*



SERIES I.

LOADS CONCENTRATED AT 6-IN. CENTRES.

445 lbs.	890 lbs.	1,335 lbs.	1,780 lbs.	2,220 lbs.
— 93	— 189	— 283	— 379	— 470
— 41	— 86	— 126	— 171	— 216
+ 1	+ 2	+ 4	+ 6	+ 8
+ 40	+ 87	+ 137	+ 189	+ 335
+ 95	+ 195	+ 299	+ 401	+ 501

By plotting the above results, diagram XXI. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in. lbs.	Deflections in inches.
445	12015	·001
890	24030	·002
1335	36045	·003
1780	48060	·004
2225	60075	·005

SERIES II.

890 lbs.	1,780 lbs.	2,670 lbs.	3,560 lbs.	4,450 lbs.
— 182	— 365	— 556	— 743	— 917
— 75	— 151	— 239	— 331	— 419
+ 7	+ 17	+ 21	+ 19	+ 24
+ 94	+ 97	+ 291	+ 383	+ 480
+ 201	+ 415	+ 612	+ 806	+ 992

By plotting the above results, diagram XXII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
890	24030	·003
1780	48060	·005
2670	72090	·007
3560	96120	·009
4450	120150	·011

SERIES III.

1,335 lbs.	2,670 lbs.	4,050 lbs.	5,340 lbs.	6,675 lbs.
— 274	— 553	— 836	— 1078	— 1325
— 115	— 244	— 381	— 514	— 645
+ 10	+ 17	+ 19	+ 23	+ 29
+ 146	+ 288	+ 431	+ 578	+ 723
+ 305	+ 613	+ 897	+ 1167	+ 1445

By plotting the above results, diagram XXIII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1335	36045	·004
2670	72090	·007
4050	108135	·009
5340	144180	·013
6675	180225	·016

SERIES IV.

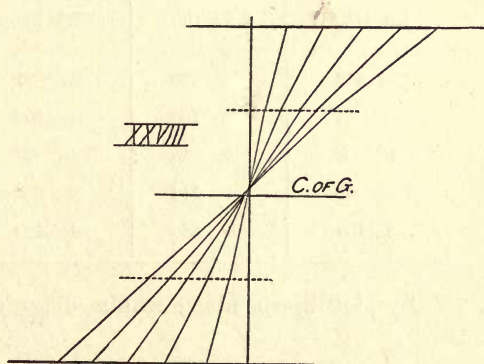
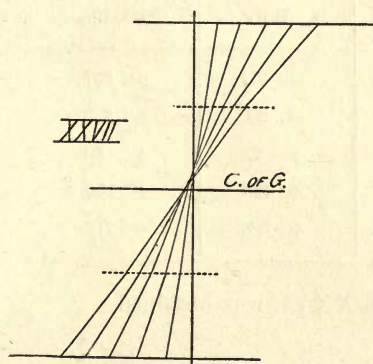
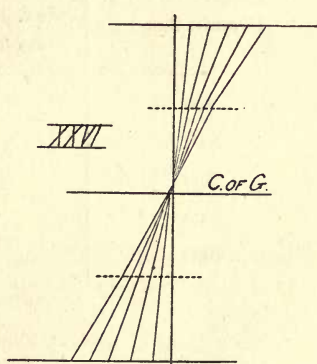
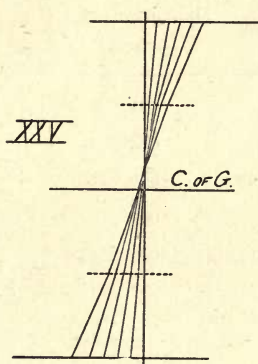
1,665 lbs.	3,330 lbs.	4,895 lbs.	6,660 lbs.	8,325 lbs.
— 340	— 683	— 997	— 1285	— 1573
— 166	— 314	— 493	— 645	— 778
+ 9	+ 21	+ 30	+ 47	+ 58
+ 197	+ 374	+ 570	+ 733	+ 893
+ 389	+ 732	+ 1002	+ 1294	+ 1594

By plotting the above results, diagram XXIV. was obtained, but only one series of observations was made in this case.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1665	36045	·007
3330	72090	·010
4995	108135	·013
6660	144180	·017
8325	180225	·020

DIAGRAMS FOR CAST-STEEL BEAM WITH LOADS
CONCENTRATED AT CENTRE



SERIES I.

LOAD CONCENTRATED AT CENTRE.

800 lbs.	1,600 lbs.	2,400 lbs.	3,200 lbs.	4,000 lbs.
— 81	— 169	— 245	— 330	— 417
— 33	— 64	— 93	— 124	— 164
+ 5	+ 6	+ 13	+ 28	+ 35
+ 38	+ 89	+ 141	+ 203	+ 255
+ 87	+ 185	+ 287	+ 398	+ 507

By plotting the above results, diagram XXV. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
800	12000	·001
1600	24000	·002
2400	36000	·003
3200	48000	·004
4000	60000	·005

SERIES II.

1,200 lbs.	2,400 lbs.	3,600 lbs.	4,800 lbs.	6,000 lbs.
— 113	— 253	— 381	— 517	— 657
— 52	— 100	— 158	— 206	— 273
+ 3	+ 13	+ 28	+ 28	+ 30
+ 61	+ 140	+ 228	+ 294	+ 356
+ 133	+ 286	+ 450	+ 586	+ 715

By plotting the above results, diagram XXVI. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1200	1800	·002
2400	3600	·004
3600	5400	·005
4800	7200	·006
6000	9000	·008

SERIES III.

1,600 lbs.	3,200 lbs.	4,800 lbs.	6,400 lbs.	8,000 lbs.
— 172	— 338	— 519	— 706	— 886
— 71	— 133	— 211	— 296	— 376
+ 3	+ 22	+ 29	+ 27	+ 29
+ 83	+ 194	+ 292	+ 376	+ 468
+ 183	+ 396	+ 586	+ 760	+ 933

By plotting the above results, diagram XXVII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
1600	24000	·002
3200	48000	·003
4800	72000	·005
6400	96000	·006
8000	120000	·008

SERIES IV.

2,400 lbs.	4,800 lbs.	7,200 lbs.	9,600 lbs.	1,200 lbs.
— 251	— 514	— 790	— 1060	— 1330
— 103	— 213	— 342	— 460	— 581
+ 14	+ 35	+ 36	+ 41	+ 46
+ 141	+ 297	+ 432	+ 567	+ 706
+ 290	+ 588	+ 853	+ 1111	+ 1352

By plotting the above results, diagram XXVIII. was obtained.

TABLE OF MAXIMUM BENDING MOMENTS AND DEFLECTIONS.

Load in lbs.	Max. Bending Moment in in.-lbs.	Deflections in inches.
2400	36000	·003
4800	72000	·006
7200	108000	·010
9600	144000	·014
12000	180000	·017

An inspection of diagrams VII. to XXIV., for the cast steel beam, shows that in all cases the stresses in the material are very approximately proportional to the distance from the neutral surface and that this neutral surface very approximately coincides with the centre of gravity, indicating that, in the case of the concentrated loads, the variation of stress in the beam in question is closely in accordance with theory.

In diagrams XV. to XXVIII., plotted from the results obtained for a beam loaded at the centre, the neutral surface has very appreciably moved towards the compression side, but the stress in the material is still proportional to the distance from the neutral surface in its changed position.

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